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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Koichi Watanabe

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3938

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EXAMINER

IP, SIKYIN

ART UNIT

PAPER NUMBER

1735

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/720,730	WATANABE ET AL.	
	Examiner	Art Unit	
	Sikyin Ip	1735	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 February 2011.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,10,20, and 27, 29-34 is/are pending in the application.
- 4a) Of the above claim(s) 32-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,10,20,27 and 29-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Newly submitted claims 32-34 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Restriction is required under 35 U.S.C. § 121 and § 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 C.F.R. § 1.499, applicant is required, in response to this action, to elect a single invention to which the claims must be restricted.

Group I: claims 1, 3, 10, 20, 27, and 29-31 are drawn to the Nb sputtering target for forming a Nb liner film of an Al interconnection film.

Group II: claims 32-34 are drawn to a method for manufacturing an Al interconnection film with a Nb liner film of an Al interconnection film.

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the common technical feature in all of the groups is the Nb liner film of an Al interconnection film in the trench. This element cannot be a special technical feature under PCT Rule 13.2 because the element is shown in the prior art. Acknowledged prior art admission discloses the Nb liner film of an Al interconnection film in the trench with resistivity of an interconnection film is $4\ \mu\Omega\text{cm}$ or less substantially as claimed in claim 29, for example.

Accordingly the special technical features linking the groups do not provide a contribution over the prior art and no single inventive concept exists.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 32-34 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 USC § 103

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3, 10, 20, 27, and 29-31 are rejected under 35 U.S.C. § 103 as being unpatentable over USP 5693203 to Ohhashi et al (col. 6, lines 32-63) in view of applicant's admission (Rule 132 declaration filed on April 12, 2004, items 3-4) or USP 4720300 to Nishizawa et al, and further in view of acknowledged prior art admission in instant specification page 2, lines 1-28.

Ohhashi discloses the features including the claimed backing plate (col. 4, lines 65-67), Nb sputtering target (col. 4, lines 61-64), grain size (col. 6, lines 1-20), and hot pressing temperature (col. 2, line 60 – col. 3, line 7). Ohhashi discloses uniformity of recrystallized structure of sputtering target would be destructured by (1) Explosive bonding, hot rolling and (3) Grooved process (col. 3, lines 35-51 and col. 4, lines 9-26). These examples show that recrystallized structure of sputtering target is expected in sputtering target taught by Ohhashi. The recrystallization temperature varies with material which is contemplated within ambit of ordinary skill artisan to use the conventional recrystallization temperature for known material in order to obtain a recrystallized structure. Ohhashi also discloses a sputtering target structure (Figure 1). Ohhashi does not disclose the % of grain deviation and O and/or Ta content dispersion in the target. However, sputtering target taught by Ohhashi is directed to uniform microstructure which requires uniform grain size and no or little diffusion of their constituent atoms (col. 6, lines 32-62). Thus, uniform grain size meets the claimed grain size range and grain size ratio (1) of adjacent grain. Ohhashi does not disclose O and Ta contents. But, claimed Ta concentration is merely conventional in crude niobium metal (Nishizawa, Tables 1, 3, or 4). Moreover, applicant's admission in Rule 132 declaration, filed on April 12, 2004, items 3-4, acknowledges that Ta and O are inevitable impurities that exist even in high purity Nb sputtering target. In view of applicant's admission, ordinary skill artisan would recognize Nb sputtering target of Ohhashi would inherently possess Ta and O as inevitable impurities. Since Ta and O are inevitable impurities, their dispersion would be uniform in Nb sputtering target. Thus, the dispersion % of said O and Ta is zero. Moreover, difference in degree of purity itself does not predicate patentability. In re King, 43 USPQ 400 and In re Merz, 38 USPQ 143 and In re Cofer, 354 F2d 664, 148 USPQ 268 (CCPA 1966).

With respect to the limitation

~~being respectively defined by the following equation, for respective measured content values~~
“ ~~of 9 specimens sampled at respective predetermined positions in the target:~~ ” in claim 1, for

example, first it is a product-by-processing step which carries insignificant patentable weight if it does not change the structure/property of the final product or claimed structure/property of the final product is disclosed by prior arts. Second, said step merely measure the dispersions of Ta and O impurities which are already in the target if they do exist. Third, in said step, the number of samplings at various positions in the target would not affect the dispersion % when the dispersion of Ta and O impurities are uniform in the target. The same first reason is also applied to steps of melting and plastic working.

With respect to the dispersion % expression, that it is well settled that there is no invention in the discovery of a general formula if it covers a composition described in the prior art, In re Cooper and Foley 1943 C.D. 357, 553 O.G. 177; 57 USPQ 117, Taklatwalla v. Marburg, 620 O.G. 685, 1949 C.D. 77, and In re Pilling, 403 O.G. 513, 44 F(2) 878, 1931 C.D. 75.

With respect to claimed use of the Nb sputtering target as liner material to Al and/or in trench (acknowledged prior art admission, page 2, lines 1-24), acknowledged prior art admission discloses the use of the Nb as liner material to Al in the same field of endeavor or the analogous metallurgical art (Instant specification, page 2, lines 20-24). The resistivity of interconnection file of semiconductor memories is required to be $4\ \mu\ \Omega$ cm or less (specification, page 2, lines 25-28). Therefore, it would have been obvious to

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one having ordinary skill in the art of the cited references at the time the invention was made to use Nb sputtering target as liner material and with resistivity $4 \mu \Omega \text{ cm}$ or less as taught by acknowledged prior art admission in order to reduce the interconnection resistance and improve reflow characteristics of Al (See instant specification page 2, lines 20-24). In re Venner, 120 USPQ 193 (CCPA 1958), In re LaVerne, et al., 108 USPQ 335, and In re Aller, et al., 105 USPQ 233.

Response to Arguments

Applicant's arguments filed February 14, 2011 have been fully considered but they are not persuasive.

Applicants argue “ ~~Ohhashi does not disclose a sputtering target with a recrystallized structure. Rather,~~ ” Although Ohhashi does not directly disclose sputtering target with a recrystallized structure, Ohhashi in “(1) Explosive bonding, Hot rolling” (col. 3, lines 35-47) and “(3) Grooved process” (col. 4, lines 8-20) discloses that said processes would destruct recrystallized structure and crystal orientation. Thus, a sputtering target with recrystallized structure is expected.

Applicants argue “ ~~the sputtering target has a recrystallized structure. Ohhashi, not disclosing a recrystallized structure, also does not disclose that each grain of the Nb grains has a grain diameter in a range of 0.1 to 10 times the average grain diameter, and a grain size ratio of adjacent grains in the Nb grains is in a range of 0.5 to 5, as in claims 1 and 27.~~ ”

But, said range and ratio include uniform grain size (1), which is taught by Ohhashi (col. 6, lines 32-48).

~~directed to uniform microstructure which requires uniform grain size.” The uniform~~
Applicants argue “ ~~microstructure of Ohhashi, however, is not the same as uniform grain size. Therefore, the~~ ” But, applicants failed to substantiate their position by factual evidence with 132 declaration.

Applicants’ argument in page 9, second paragraph of instant remarks is noted. But, first, it is clear that Ohhashi does not want recrystallized structure destructed (“(1) Explosive bonding, Hot rolling” (col. 3, lines 35-47) and “(3) Grooved process” (col. 4, lines 8-20). Second, the invention defined in a product-by-process claim is a product, not a process. In re Bridgeford, 357 F. 2d 679, 149 USPQ 55 (CCPA 1966) and MPEP § 2113. It is the patentability of the product claimed and not of the recited process steps which must be established. See In re Brown, 459 F. 2d 531, 173 USPQ 685 (CCPA 1972). The guidance that has been provided by court on this matter is

[i]f the product in a product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.

See In re Thorpe, 777 F.2d 695, 227 USPQ 964, 966 (Fed. Cir. 1985). When applicant’s and prior art’s products are to be identical or substantially identical, the burden shifts to applicant to provide evidence that the prior art product does not inherently possess the claimed properties. In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977); In re Marosi, 710 F.2d 799, 803 (Fed. Cir. 1983); In re Fessmann, 489 F.2d 742, 745 180 USPQ 324, 326 (CCPA 1974); and In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980). Third, applicants failed to show recited steps are the only steps to form recrystallized structure.

Furthermore, with respect to claim 4, Ohhashi and Nishizawa do not disclose the Applicants argue "claimed Ta and oxygen content. Specifically, Ohhashi does not disclose that the sputtering " But, applicants' attention is directed to Tables 1, 3, and 4 below:

the iodine purification tower
Niobium iodide forming rate 5.4 g/min 7.5 g/min

25 are as shown in Table 3.

TABLE 3

Thermal reduction temperature (°C.)	Ta content (based on Nb) (ppm)	Yield of Nb (%)
250	895	87
300	90	91
350	20	93
400	10	97
450	9	98

The purification effects by the production of niobium iodide under the above conditions are shown in Table 1.

TABLE 1

	(1)			(2)		
	Ta	Fe	Al	Ta	Fe	Al
Crude niobium metal (ppm)	2000	50	30	2000	50	30
Impurities (as calculated as niobium) in the iodide (ppm)	180	2	5	200	1	6

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Example 2-2

The thermal reduction was conducted under the same conditions as in Example 2-1 except that 150 ml/min of hydrogen gas was used as the carrier gas. The results are shown in Table 4.

TABLE 4

Thermal reduction temperature (°C.)	Ta content (based on Nb) (ppm)	Yield of Nb (%)
300	890	97
350	130	98
400	15	99
450	5	97
500	4	96

45

As shown above, the yield was remarkably improved

TABLE 2

	Nb (wt. %)	Bound iodine (wt. %)	Free iodine (wt. %)	I/Nb (molar ratio)
(1)	12.95	87.05	5.02	4.92
(2)	12.80	87.08	5.05	4.94

50

Moreover, applicants' admission in Rule 132 declaration, filed on April 12, 2004, items 3-4, acknowledges that Ta and O are inevitable impurities that exist even in high purity Nb sputtering target. It is well settled that difference in degree of purity itself does not predicate patentability. In re King, 43 USPQ 400 and In re Merz, 38 USPQ 143. Changing form, purity, or other characteristic of an old product does not render the novel form patentable where the difference in form, purity or characteristic was inherent in or rendered obvious by the prior art. In re Cofer, 354 F2d 664, 148 USPQ 268 (CCPA 1966).

Thus, Ohhashi and Nishizawa do not disclose nor suggest a Nb sputtering target in which a dispersion of the Ta content is within 30% and a dispersion of the oxygen content is within 80%. Further, Ohhashi and Nishizawa do not disclose nor suggest that such a Nb

Applicants argue " within 80%. Further, Ohhashi and Nishizawa do not disclose nor suggest that such a Nb

But, if the dispersion is uniform (maximum value equal minimum value), then the dispersion is zero. Ohhashi discloses target having uniform microstructure (col. 6, line 42) and with no or little diffusion of their constituent atoms (col. 6, lines 57-58). That reads dispersion is zero. Furthermore, the instant claimed dispersion (%) of oxygen is

up to 80% (claim 1) which hardly excludes any dispersion. Assuming arguendo that the Ta dispersion is non-uniform as targets 3 and 4 in instant Table A. The difference of resistivity of interconnection film is less than 3%. Thus, the claimed dispersion (%) has no criticality or unexpected result. In view of data in instant specification that, the claimed dispersions do not have significant affect on sputtering target properties. Page 21 of instant specification, Table 1, targets 5 and 6 show that claimed dispersion (%) has no effect on resistivity of interconnection because targets 5 and 6 both have resistivity of interconnection way above targets 1-4. Moreover, there is no evidence that the Ta impurity in Ohhashi is over 3000 ppm. Examples in instant specification are intentionally adding Ta and O. There is no controlled sample to show Ta and O contents and their dispersions.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. USP 5409862 to Wada et al discloses high purity Nb material as liner material (PTO-1449, Figure 11 and col. 11, line 25 to col. 12, line 42).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Applicant is reminded that when amendment and/or revision is required, applicant should therefore provide a concise explanation and support with page and line number in the specification for any amendments made to the disclosure. See 37 C.F.R. Part §41.37 (c)(1)(v).

Examiner Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Ip whose telephone number is (571) 272-1241. The examiner can normally be reached on Monday to Thursday from 5:30 A.M. to 4:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica L. Ward, can be reached on (571)-272-1223.

The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Sikyin Ip/
Primary Examiner, Art Unit 1735
April 25, 2011